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THE MINING REGIONS OF SOUTHERN NEW MEXICO.

BY F. M. ENDLICH.

FEW regions, perhaps, attract so much attention at present as the southern portion of New Mexico. Three factors combine to render this section of country interesting to the inhabitants of more civilized domains. Within the past year large areas have been rendered accessible to travelers and investors by the completion of an overland railroad; the discovery of mineral wealth in regions where heretofore it was barely suspected, has imparted the usual energy to the influx of labor and capital, and, lastly, the sporadic appearance of raiding Apaches and their allies has called special attention to the region containing their battlefields.

Upon leaving the railroad traveling assumes a somewhat primitive aspect. Coaches or "jerkies," which latter fully justify their name, are substituted for palace-cars, and "natural roads" supply the place of carefully-ballasted tracks. As a rule the country is well adapted for travel, but little work being required in constructing good roads. All points of prominence can be reached by stage from the railroad. On one of the routes a representative of the immortal "forty-niners" handles the ribbons with consummate skill. "Jim" is a well-known character; the ease with which he guides his team on its daily trip of sixty-five miles, the accuracy with which he steers the coach through a narrow, rocky cañon after nightfall, and his efforts in behalf of the comfort of his passengers, render the drive with him an agreeable recollection. Along the road small, circular or straight walls, hastily thrown together, may often be seen; they mark the spots where unfortunate travelers fought their last, desperate fight against raiding Indians. Even to-day, although danger is rapidly diminishing, the interior of a stage-coach full of passengers emulates the character of an arsenal. However cumbersome the transportation of murderous weapons may be, it is well not to forget the frontier maxim: "Look out for Indians when you don't expect them."

In days gone by mining was carried on in the copper-bearing localities, and active operations were long ago pursued in the vicinity of Silver City and Georgetown. Argentiferous strata and veins, decomposed near the surface, afforded ample yield of the precious metal. Mexican labor first separated the silver from its base surroundings until the difficulties of deep mining proved too formidable for the indolence of native inhabitants. "White man's" energy and perseverance readily overcame such obstacles until, to-day, the two old-established silver camps are in a thriving condition. Works have been erected for the extraction of silver on the Rio Mimbres and at Silver City, so that the ores are treated within a few miles of their original occurrence. At Santa Rita the copper mines still lie idle, waiting, perhaps, for the magical wand of capital to rouse them from their long period of inactivity. Enormous dumps in the vicinity of the mines speak of great masses of removed material, while ruins of smelting works testify to the extraction of copper from its ore. Now the surroundings of these mines are desolate, be the cause a want of confidence in their productiveness, or be it but one of the many accidents which caused desirable deposits persistently to be mismanaged and neglected.

Indian troubles, to use a standard expression, have somewhat retarded the development of Southern New Mexico within the last few years. Victorio, with his great topographical knowledge, was a born strategician, and in more than one instance brought about the defeat of his enemies by superb leadership. It seems almost ridiculous to the passive spectator, that a mere handful of soldiers, however brave, should be expected to cope with an outnumbering force of savages who have every advantage on their side, and who are fighting with fanatical ferocity under capable superiors. They are well armed, held in good discipline and never strike unless fully prepared to maintain the field. In the Black Range and in adjacent mountains the bleaching bones of cavalry horses tell a tale of battles heroically begun and disastrously concluded. By losses in fights, through the kindly offices of our Mexican neighbors, and in consequence of disease, the original band of marauding Apaches has been reduced to about fifty men. Implacable to the last breath, these still hold out, reinforced, no doubt, at convenient points, by disaffected Indians of other tribes, who quietly return to their agencies after having gained plunder and satisfied their warlike inclinations. Running southward from the *Ojo Caliente*, the main traveling trail of the Indians passes through a part of the country which now is gradually developing into a series of mining districts. In the spring and fall, as the grass grows and as it withers, the restless bands follow this trail, murdering whomever they can surprise, fighting when safely concealed behind boulders and rocks, running away when pushed into open country. Increasing settlement and the present distribution of military forces under the command of General McKenzie, will have the effect of speedily quieting any further disturbance. Everything is so arranged that a raid can be speedily intercepted, and it is scarcely probable that the scenes of last year will be reënacted.

Within the past year especial attention has been directed towards the mining developments of the Black Range and several of the subsidiary mountain ranges. The Cuchillo mountains, the San Andrea, San Mateo, Caballo, Organ and other isolated groups, have been prospected with more or less success, and work is being prosecuted at many points. At the very borders of a Sierra system which culminates in the Black Range, the mining region of the Lake valley has made the most marked progress. The extent of its deposits, the richness of certain occurrences and the accessibility of the district have directed general notice towards the young camp.

Topographically the entire region is very simple; great areas of plateau land, reaching an altitude of 4000 to 5500 feet above sea-level, are traversed by narrow, monoclinal ranges which trend approximately north and south. They generally owe their most elevated portions to the existence of erupted material. Broad expanses of rolling plains or mesa-like highlands separate the ranges from each other. Water as a rule, is scarce. Within the mountains small streams and springs are abundant, but the majority of them sink upon reaching the open country. Long, narrow valleys, enclosed by undulating hills or steep bluffs, frequently contain lakes or marshy places where water can be obtained by sinking but a short distance. These *cienegas* afford admirable ground for cattle-raising, being supplied with luxurious grass and plenty of shelter. Oak, cedar, piñon and yellow pine are distributed in conformity with elevation and supply of moisture.

Along those streams which attain sufficient volume to withstand the absorbent qualities of the valley-soil, notably the Mimbres and the Cuchillo Negro, Mexican settlements eke out their lazy existence. In the hands of an enterprising people all valleys thus supplied with water might be rendered highly productive. A little corn, plenty of red pepper, the national *chili colorado*, a few sheep or goats and pigs comprise the worldly ambition of the swarthy inhabitant. Cutting ditches for irrigating purposes, planting and reaping more grain or corn than is needed for individual wants, require labor, and life seems too short to the Mexican to waste it in so uncongenial a manner. Now and then an American (American by way of distinction) ranch will be met with, and its possessors are found in enjoyment of ample returns for their thrift and industry.

A Mexican town presents a very forlorn appearance. Gray mud composes the buildings, brown mud the streets and black mud the fields or gardens. Lazy, dirty, wretchedly poor, the inhabitants manage to procure from day to day the means of keeping body and soul together. Few of them can be persuaded to work unless it be in connection with horses or cattle. Squalling children and lean, sharp-backed pigs wallow in mud, alike, almost, in appearance as in intellect. Even one of the chief amusements of our own more civilized backwoods, sitting on fence-rails of a Sunday and whittling, is denied these unfortunate creatures. Whenever an attempt at fencing is made, our posts and rails are supplied by a wall of sun-dried brick, on the top of which are planted dense rows of aggressive cactus. Small as the intelligence of the average Mexican farmer may be, it suffices to teach him that cactus are not pleasant to sit upon for Sunday recreation. Only their graveyards are in good condition; they are carefully tended, embellished with numerous white crosses, and protected by massive walls against the interference of coyotes.

Since the discovery of metalliferous veins, coinciding as it did with the advent of a railroad, large numbers of prospectors, miners, mechanics and a fair percentage of professional scoundrels have flocked into the country. Small "American" settlements have sprung up in the mining regions, notably Grafton, Hillsboro and Daly (Lake valley), so that the extraction of ore is gradually assuming the character of a legitimate business enterprise throughout the Black Range and its adjoining districts. Prospectors are daily covering more ground, and ere long the more distant ranges will be drawn within the circle of active operation. Reports, vague as yet, fill remote mountains with untold wealth, but a short time only may elapse before definite knowledge and practical demonstration will separate truth from fiction.

Geologically speaking the structure of Southern New Mexico is not complicated when viewed on a large scale, although a thorough recognition of details would require careful study. Taking the general character of the ranges it may be said that they exhibit a large mass of erupted material which forms their highest peaks. Flanking the latter are sedimentary beds, referable mainly to the Palæozoic groups. These follow essentially a monoclinal arrangement more or less complicated by faults. Sharply defined, the ranges trend north and south, end more or less abruptly, and, though orographically disconnected, belong to one general period of geological disturbance. In elaborating the geognostic details, however, a wide field for observation is encountered. Without attempting to enter minutely upon a subject which would carry us far beyond the limits assigned to this paper, it may be well to sketch, in brief outlines, the distinctive features of the region under discussion.

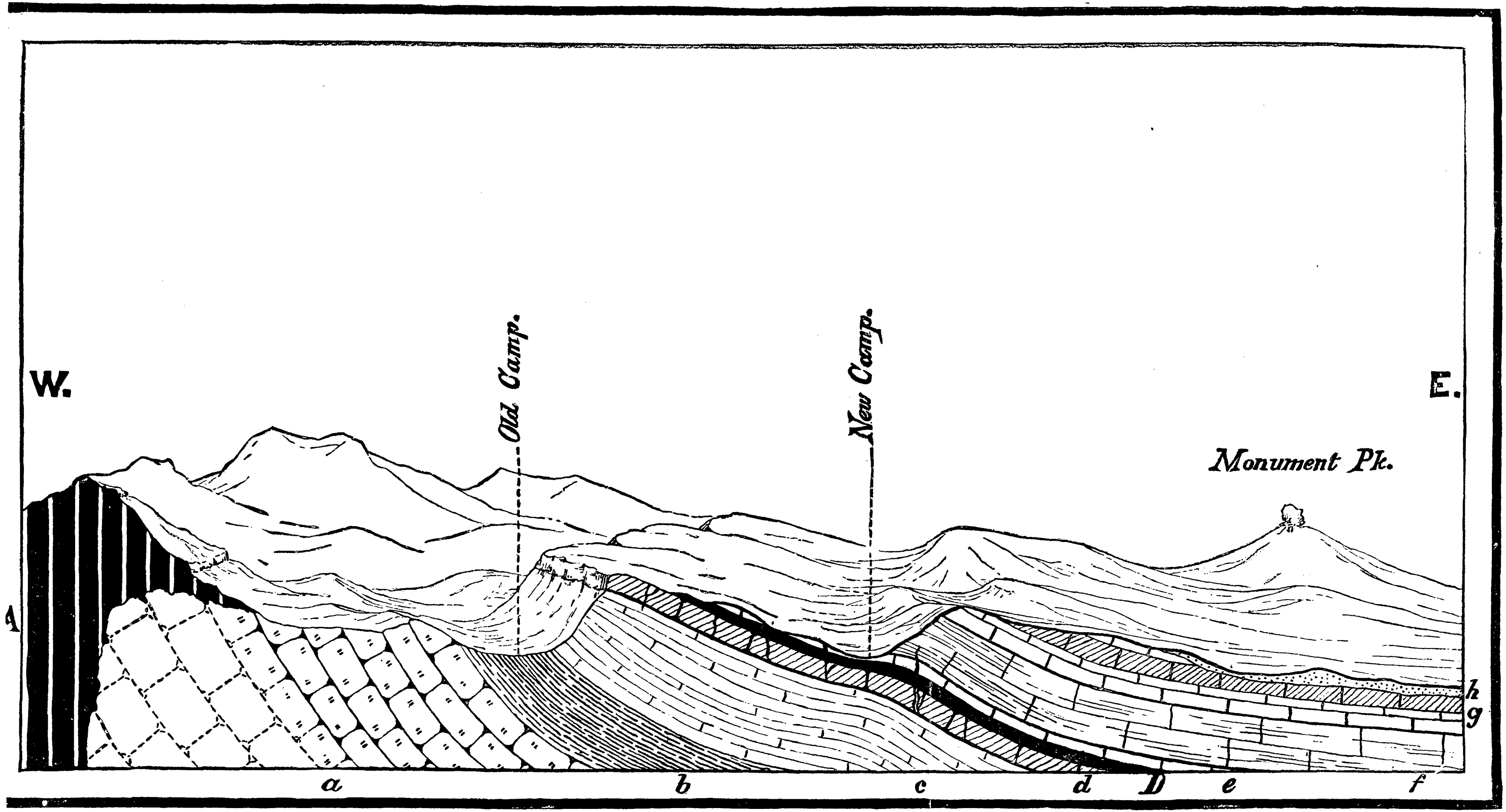
Keeping in view the presence of eruptives which form the bulk of the mountain ranges, we find the adjacent sedimentary beds traversed or covered by the volcanic material in every direction. Trachyte, resembling that of the San Juan region in Colorado, predominate. Dolerites, in part sanidinitic, are not wanting, but subordinate. Dikes of trachyte set across either dip or strike of sedimentary strata, and intrusive wedges of the same material are held between the latter. From the main points or lines of issue the trachytes have spread in the form of flows, wherever their quantity and the surface of the locality permitted. Arranged in nearly horizontal layers, they now cover unconformable sedimentary beds. Erosion has carried away large portions of erupted material, leaving isolated remnants of flows and again exposing the underlying formations.

Among the sedimentary beds those belonging to the Carboniferous period are most fully represented, although Silurian quartzite and the characteristic " red beds " of Mesozoic age are also found. Wherever contact has been established with the trachytes, the traces are plainly visible in the limestones predominating in the Carboniferous series. The influence of heat has caused a certain amount of fritting, a characteristic discoloration and the formation of numerous, irregular fissures, cracks and seams. Even where the overlying volcanics have been removed by erosive agents, their former position can often be established by the record they have indelibly stamped upon the strata which were exposed to their altering influence. A large percentage of the total area is covered with heavy deposits of drift, sometimes several hundred feet in thickness, whereby all recognition of underlying beds is rendered impossible.

Considering the relations between sedimentary and volcanic material as exhibited in this region, it is but natural that the existence of extensive veins should be expected. In truth, such veins are found, and by virtue of surrounding rocks they are metalliferous. In the heart of the Black range, at and near Grafton, well-defined veins traverse the limestones as well as the trachytes, bearing definitely characterized gangue and ore. Frequently they lie in contact between the two. Their gangue is mainly quartz in this region. As quartz resists decomposition more successfully than the enclosing walls, the veins can often be traced for long distances. Generally they cut the edges of the limestone strata, *i. e.*, their strike coincides with that of the beds they traverse. Occasional faults and cross veins are produced by the occurrence of dikes, which, in turn, are almost as persistent in course and continuity as the veins themselves. Near Hillsboro' similar veins have been found, and are now profitably working. While these latter carry gold as the paying metal, silver usually predominates, and gold in excess of a few ounces per ton enters only sporadically. At Hillsboro' the auriferous character of deposits has given rise to the formation of gold-placers. Located within accessible distance from water, they have been turned to account and are now yielding their precious metal under the persuasive influence of hydraulic mining.

On the waters of the Pirches, above Hillsboro', and at Lake valley, the ore deposits show a totally different geognostic and mineralogical character, although their associations are essentially the same. While the more northerly mountains hide their metallic treasures in well-defined veins which cut through and across the country rock; while these veins carry a specific gangue with the argentiferous and auriferous minerals distributed therein ; in short, while they promise to develop into orthodox,

PLATE III.



SECTION OF THE SILVER-BEARING DISTRICT OF LAKE VALLEY, NEW MEXICO. SEE TEXT.

old-fashioned mines, we here meet with ore bodies of totally different genesis, different relative position and different minerals. Instead of barren gangue and paying ore, we find a deposited accumulation of ore varying in value; instead of argentiferous *veins* we have argentiferous *beds.*

At Lake valley active work has been going on since the spring of 1881. As this district shows more prominent development than others of a similar character, it may be well to enter into some detail concerning genetic and stratigraphical conditions, both of which are of exceptional interest. For the purpose of presenting the subject in a more comprehensible manner, a section may serve which has been taken across the strike of the ore-body.[1]

Beginning at the western end of the section we find a portion of the trachyte (*A*), belonging to the range which has broken through and partly overflowed heavy beds of quartzite (*a*). The latter are probably of Silurian age. They dip steeply away from the mountains until hidden from sight by a series of dark gray shales (*b*). A narrow valley, in which the old camp was located, is eroded into the shales, readily yielding, as they do, to disintegrating and transporting agents. So far as could be determined, the argentiferous shales of Silver City belong to this horizon. Above them light gray and yellow calcareous shales (*c*) form the steep approach to the summit of the first outlying "hog-back" or ridge. The latter is protected by a capping of massive blue, silicious limestones (*d*). This limestone forms the floor, or, using mining parlance, "foot-wall" of the ore-bed (*D*). Conformable in every way to over and underlying beds, this deposit of argentiferous ore must be regarded as an integral member of the series of strata which compose the two parallel ridges or hog-backs. Overlying the ore-bed we find a more or less compact, whitish limestone, the "hanging-wall" (*e*), followed by a succession of fossiliferous, argillaceous limestone (*f* and *g*), which, in turn, are hidden by drift (*h*). About thirty species of fossils were here collected, the identification of which refers the series to the Lower Carboniferous formation.

Both limestones which form the walls of the interstratified ore-bed, are traversed by ore-bearing veins and seams. Usually these are of comparatively small dimensions, stand nearly vertical, and show ore of a higher grade than the bulk of the main deposit. It is a noticeable feature that no such veins have been found in the shales (*c*) underlying the foot-wall strata (*d*). Mineralogically the ore of this locality must be considered as an aggregate of manganese and ferric oxides with but a slight admixture of gangue rocks. The silver is distributed throughout the mass of ore in the form of cerargyrite (chloride), embolite (chloro-bromide) and a small percentage of argentite (sulphide). It is well known how the first two of these minerals were struck in large quantities, of great purity, at various points in the ore-bed, furnishing ore worth from five to ten dollars a pound.

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[1] It must be stated that the section is not made on scale, as no accurate contour surveys of the surface have been made thus far.—E.

Near the crest of the first ridge the ore-bed has been removed by erosion, together with the overlying strata. On its easterly slope mining is essentially reduced to open quarry work, because the hanging-wall (*e*) has been broken away at many places. Following the dip of enclosing strata, the ore sinks out of sight under the second hog-back, directly east of the new camp. Along the strike of the strata, *i. e.*, approximately north and south, the ore-bed either crops out or has been struck in its normal position for a distance of more than 2000 feet, always bearing the same relations to adjoining strata. Towards the east it may extend indefinitely. No disturbing action has turned up the strata in that direction, so that the point could be demonstrated. Defining, then, in a few words this occurrence, we find it to be: a manganese and iron bed, conformably interstratified with carboniferous limestones, impregnated and associated with specific silver minerals.

Beyond the establishment of this ore-body as a well-defined stratum, a highly interesting question is propounded in the existence of the transverse veins and seams above alluded to. Primarily we may take for granted the formation of a manganese and iron bed, synchronously with the deposition of the entire sedimentary series. From evidence obtained in the vicinity of Lake Valley, it appears that the trachyte flowed from the more elevated regions in an easterly direction. Subsequent disturbances and erosion affected the removal of the larger portion of the volcanic material. Monument peak, in close proximity to the mines, is a remnant of a flow from the westward. There seems no room for doubt but that the ridges now containing the ore-bed were at one time covered by the trachytic flows. It is further found that the hard, unyielding strata of limestone and quartzite are fissured and cracked to a very great extent, while the more pliable shales are not so affected. The argillaceous limestones (*f*) show fissures of only small dimensions. It seems highly probable, therefore, that the combined pressure and heat of the superincumbent trachytes should have been instrumental in causing the extensive system of fissuring now observed more particularly in the limestone walls. Wherever cracks thus formed were in connection with the original ore-bed, they would have been filled from the latter, by some process, probably, which could derive material aid from the presence of heated masses overlying. One hypothesis of this kind might also account for the high average grade of ore found in the transverse veins as compared with the main ore-body.

The treatment of ores from the districts above described has met with no obstacle thus far. By milling process the lower grades can be utilized, while smelting is advisable for the higher. For a long time the Mexicans have smelted a limited quantity of certain classes of ore. They are, no doubt, very skillful in manipulating ores with which they are familiar, but their crude methods and their conservatism, born of constitutional laziness, prevent their harvesting the riches of the country they inhabit. It is surprising, sometimes, to see the results obtained by them in their small *adobe* furnaces. Capable of smelting perhaps 500 pounds of ore a day, the construction closely resembles that of an ordinary silver-lead furnace. By means of cupellation, all blast being supplied by hand-power bellows, they produce silver of 930 fineness. Their entire plant seems almost like a plaything, but it is constructed upon sound principles and handled with enviable skill. Until the arrival of Eastern machinery these miniature smelters afforded the only means of extracting the precious metals from their ores. Now they have had their day, and are rapidly falling into disuse.